“How Do You Know If They Help?” Implementing Multiple Student-Centered Learning Opportunities in Human Anatomy and Physiology Undergraduate Labs

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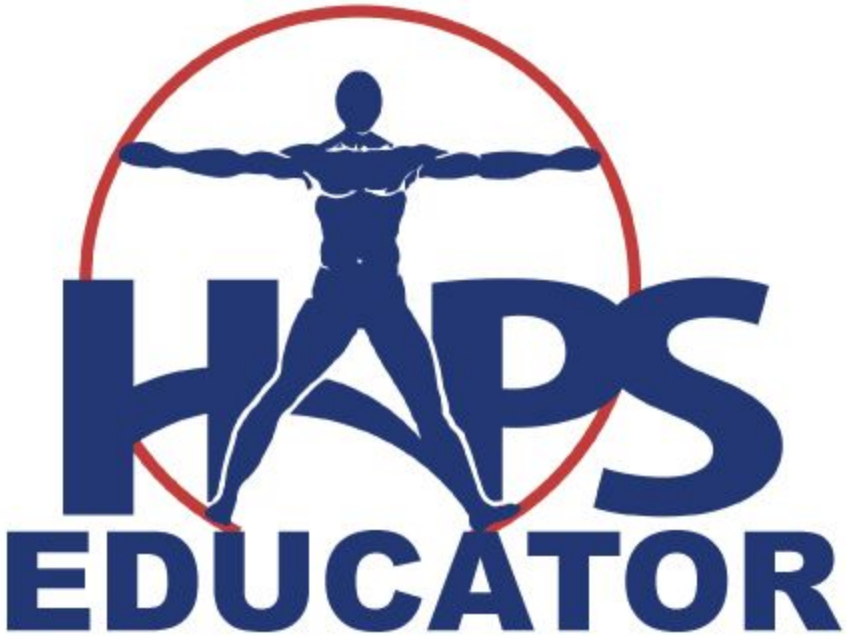

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"How Do You Know If They Help?" Implementing Multiple Student-Centered Learning Opportunities in Human Anatomy and Physiology Undergraduate Labs

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Abstract
To improve the student learning outcomes of an introductory Human Anatomy and Physiology course we have implemented many changes over the last two years. In this study, the third of a three-part series, we present data from surveys collected and analyzed during the spring semester of 2018 at the University of Northern Colorado. The results reveal that the most appreciated change for most students, regardless of the final grade earned, was the affectionately named "Vanessa videos", which are described in parts one and two of this series. According to the students surveyed, the Exit Quizzes were the most emotionally distressing learning opportunity. Grade improvements during the semester ranged from 0.07-13.4%. Having access to a variety of learning opportunities, such as customized online videos, student-made study guides, and frequent low-stakes assessments appears to provide the greatest benefit to the widest range of students. https://doi.org/10.21692/haps.2018.027

Key words: student-centered learning, survey study, customized teaching, flipped learning, learner-centered teaching

Introduction
In 1925, Dewey described learning as:
"emerging through experience, that is, action within the world in which we live, action related to solving problems and meeting ends, and through that action, building new structures of knowledge and understanding" (as cited in Bresler 2004 p. 198).

Eighty years later, neuroscientists have provided tangible evidence that physical actions stimulate learning areas of the brain related to language and that language about physical actions stimulates areas of the brain that prepare the body to perform those actions (Pulvermüller 2005). However, Avraamidou and Osborne (2009) suggest that while scientific concepts are grounded in scientific inquiry, they are often presented in scientific language, creating comprehension challenges for non-scientists. Anatomy and physiology terminology could certainly be considered a language of its own. Despite almost 100 years of research supporting active hands-on experiences as effective ways of learning, many traditional human anatomy labs still rely on memorization, use of mass-marketed lab manuals, and few high stakes assessments to evaluate learning objectives (Gopalan 2016, McDaniel and Daday 2017, Rawson and Dunlosky 2012).

As a postdoctoral fellow hired for a 20/80 teaching/research position in 2015, I was enthusiastic to start my own research projects and spread my fascination with qualitative methods to others in my new department while improving my limited quantitative research skills. After a year of teaching introductory biology to incoming students majoring in the field, I transitioned to teaching my favorite subject, Introduction to Human Anatomy and Physiology. Aside from wanting to become a more adept researcher, I wanted to apply the research theory learned while earning my PhD through the inclusion of active learning techniques. Ultimately, I sought to make the labs and lectures a positive and effective learning experience for my students. I met with my graduate teaching assistants (GTAs) before the semester began and, together we sought opportunities to improve the structure of the labs and lectures. This study looks specifically at lab improvements. Fortunately, the three GTAs assigned to teach the labs that semester had extensive learning and teaching experiences specific to human Anatomy and Physiology courses. Through collaboration and peer learning, both of which are recognized in the literature as effective forms of active learning (Freeman *et al*. 2014, Hughes 2011, Moyer 2016), we made several changes to the structure of the lab that we hoped would also promote positive learning outcomes for our students (Rudolph *et al.* 2018, Rudolph and Schwabe 2017).

These changes have evolved over the last two years and have been applied to labs encompassing nearly 1,000 students. The purpose of this study was to examine how undergraduate students utilize these learning opportunities that are now embedded in the structure of Anatomy and Physiology labs at the University of Northern Colorado (UNC). We were particularly interested in (1) which learning opportunities do students report using most (2), if the use of learning opportunities is correlated with grades (3) if learning opportunity use changes over the semester, and if so, why and (4) if the number and/or types of learning opportunities relate to grade improvements in lab.

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Materials and Methods

All students enrolled in introductory Anatomy and Physiology labs at UNC (N=327) were invited to participate in this study during the spring semester of 2018. There are no prerequisite courses or minimum GPA required for enrollment in the course. The enrolled students were provided a consent form during the first week of the semester to sign if they were willing to participate in the study. The researchers were in contact with the students throughout the semester, but completed surveys were stored and not analyzed until completion of the semester and final grades had been disseminated. One hundred and seventy-eight students gave their consent and participated in the first survey (Appendix A), while ninety-six students responded to the second survey (Appendix A). All participants were 18 years of age or older and did not represent any known, vulnerable populations. Random numbers were assigned to all participants and names were removed to protect identity before data analysis began.

The Internal Review Board of the University of Northern Colorado approved this project, IRB# 1195188-1, and informed consent was obtained from all participants. Informed consent allowed us to distribute the surveys, access lab grades for data analysis, and take pictures of students doing activities during labs. Pictures will be used in conference presentations and potential future articles.

Survey 1 was conducted after grades were recorded following the 1st practical exam. Surveys were provided to all students enrolled in the course, but only those surveys for consenting students were included in the analysis. Survey 1 included five questions. Question 1 provided a list of learning opportunities students may have participated in and asked them to check the boxes of the ones they used to prepare for their practical exam. Responses were recorded as presence-absence data to indicate which opportunities students utilized and which were used most often. The remaining survey questions were open ended.

The second survey, Survey #2, was administered after the completion of the final practical. Survey #2 included the original five questions plus one additional question that allowed us to assess changes the students made in study behavior over the course of the semester. Both surveys were conducted during scheduled laboratory periods and required less than ten minutes to complete (Appendix A).

Data for the first survey question were entered into Microsoft Excel spreadsheets for analysis using "1" to indicate learning opportunity used and "0" to indicate learning opportunities that were not used (*i.e.* binary format). Learning opportunity categories for the first survey question included the following:

Term sheets: This is the list of terms students are tested on. We included this as a learning opportunity option on the survey and nearly all students marked that choice. However, we did not include results of term sheet use in this paper because we felt that knowing the terms on the list is a requirement for the course and it is not truly a "learning opportunity."

Vanessa videos: These are online instructional videos of one of our GTAs, Vanessa Johnson, clearly walking the viewer through all of the terms on the list for each practical using the models available in our lab. Vanessa also provides tips and tricks to help students remember the information. These are referred to as the "Vanessa Videos."

Homework PowerPoints: These are student-made electronic photographic study guides in a PowerPoint format synthesized during lab times under the supervision of GTAs and/or undergraduate teaching assistants (UTAs).

Pre-Labs: These homework exercises are completed by the students prior to lab as a first learning opportunity to help students become familiar with terms.

Entrance Quizzes: Cumulative entrance quizzes are conducted at the beginning of each lab to reinforce and check retention of material from the previous weeks' labs in preparation for the next lab practical. The entrance quizzes consist of 10 one-point questions, and are presented in a PowerPoint slide show with photographs of the models used in lab. Quizzes are cumulative and include material from previous labs, but not from material that has not yet been covered.

Exit quizzes: These are five-question quizzes are given at the end of each lab to check for learning progress during the lab period that day. These quizzes are in the same format as the practical exams in that there is a station with a model indicating a structure that the student is asked to identify.

Practice Practical: This is a low-stakes mini practical exam the students take one week prior to the first practical exam. Many students have never taken a practical exam and this experience is designed to assess the effectiveness of their study techniques. The practice exam is peer-graded in class to provide immediate feedback, so students have time to adjust studying techniques prior to the high-stakes practical exam. Since a practice practical was only administered before practical #1, we do not include it in the survey #2 analysis.

Open Labs: GTAs hold office hours as "open labs" when labs are not scheduled, increasing the time available for students to study under the guidance of a knowledgeable supervisor. We divided this into two categories to explore whether students were making a point of going to open lab with their respective GTA, or any open lab, categorized as "Open Lab (any)" and "Open Lab (with your GTA)."

Mini Lecture PowerPoint Presentations: After entrance quizzes are conducted, GTAs give a short (~10 minutes) PowerPoint lecture. These provide labeled figures designed to help students identify and understand topics and structures for the current week's lab. The PowerPoints can be helpful to students

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when they are looking for the structures to label while doing their Homework PowerPoints. They are available for students on the Learning Management System (LMS) for further study outside of lab times.

Meeting with GTA: This category refers to an appointment a student makes for additional one-on-one time. This was provided as a category as some students' schedules conflicted with official open-lab office hours. The mini-lecture is simply an overview of the current week's material. For this reason, we did not consider instructional differences among GTA's.

Class Lecture Notes: Since we have worked to align lecture and lab topics, we included this as a category as a learning opportunity.

Other: This category was added to learn what students were using to study that we might include at a later date. It included a prompt to explain what was used if the box was checked.

Quizlet: On Survey #1, we noticed several students writing in "Quizlet," which is a free online, flashcard program where students can make their own quizzes and can access quizzes other students have made. Given the high occurrence of student reference to this resource in the "Other" category, we created a category in the analysis specifically for Quizlet and collected data for Survey #1 and Survey #2.

Learning categories with positive values were summed to determine the frequency of usage for each learning opportunity. Scatterplots and R^2-values were generated in Microsoft Excel and used to address research questions 2 and 4. Excel generated the scatterplots for each learning opportunity and 12 graphs for the relationship between learning opportunities and final grade received in the lab were produced. The trend lines for the graphs were calculated and R^2 values are reported in Table 1. R^2 is a statistical measure of how close the data are to the fitted regression line and it is also known as the co-efficient of the regression. We chose not to use chi-squared test because our regression analysis was as informative as chi-squared analysis for our research. We also generated 11 scatterplots to determine the relationship between the learning opportunities and overall grade improvement in the class and inserted the trend line. R^2 was calculated and is shown in Table 2 for these scatterplots. To analyze question 4, "How often did you use the learning opportunity(ies) that you found most helpful?", we grouped students' responses to the question into six categories and created codes for each. The categories were: never, 1-2 times per week, 3-4 times per week, 5-6 times per week, every day, and vague (for example, "as often as I could). Question 5 on Survey 1 and question 6 on Survey 2 asked for suggestions to improve the labs. Question 5 on Survey 2 asked if students changed how they studied during the semester and if so, why?

We were interested in variables that are predictive of grade improvement. Therefore, individuals that did not represent our question of interest (grade improvement) were intentionally removed from the dataset. We calculated grade changes and removed those participants who specifically did not improve over time. We felt that including students whose grades did not improve would confound the results of interest (grade improvement) and the possible relationship with the various ancillary materials.

Results

The following reported results only include students who provided consent to participate in this study. By filling out the surveys we determined students were inherently reporting their preference of their study methods. The correlation, signified by R^2, measures the amount of linear association between each learning opportunity and their grade improvement. The higher the R^2 the more significant the relationship between the student's usage of learning opportunities and their grade improvement. Based on our sample size and the grade improvement, we considered an R^2 higher than 0.35 as showing a stronger relationship.

The learning opportunities students reported using to prepare for the 1st practical were the highest for Homework PowerPoints (76.40%), followed by the Practice Practical (47.75%), Pre-Labs (44.38%), and the Vanessa Videos (43.25%). To prepare for the 2nd practical, the highest reported usage by students was, again, Homework PowerPoints (73.96%). However, their second highest choice for studying was Vanessa Videos (56.25%), followed by Pre-Labs (38.54%), and Class Lecture Notes (32.29%) (Figure 1).

Table 1. *Correlation of learning opportunity with final grade received in the lab section of the course. Students who reported using the Vanessa Videos had the greatest positive correlation on the final grade received in lab, while Entrance Quizzes had the greatest negative correlation with the final grade received in lab. The Homework PowerPoints as a study tool did not seem to correlate with the final grade received in the lab.*

Opportunity Used	R^2
Vanessa Videos	0.563
GTA Specific Open Lab	0.432
Lab Mini-lecture PowerPoints	0.361
Open Lab	0.175
Other	0.150
Class Lecture Notes	0.080
Quizlet	0.072
Homework	0.000
Meeting with TA	-0.006
Exit Quizzes	-0.039
Pre-lab Exercises	-0.247
Entrance Quizzes	-0.671

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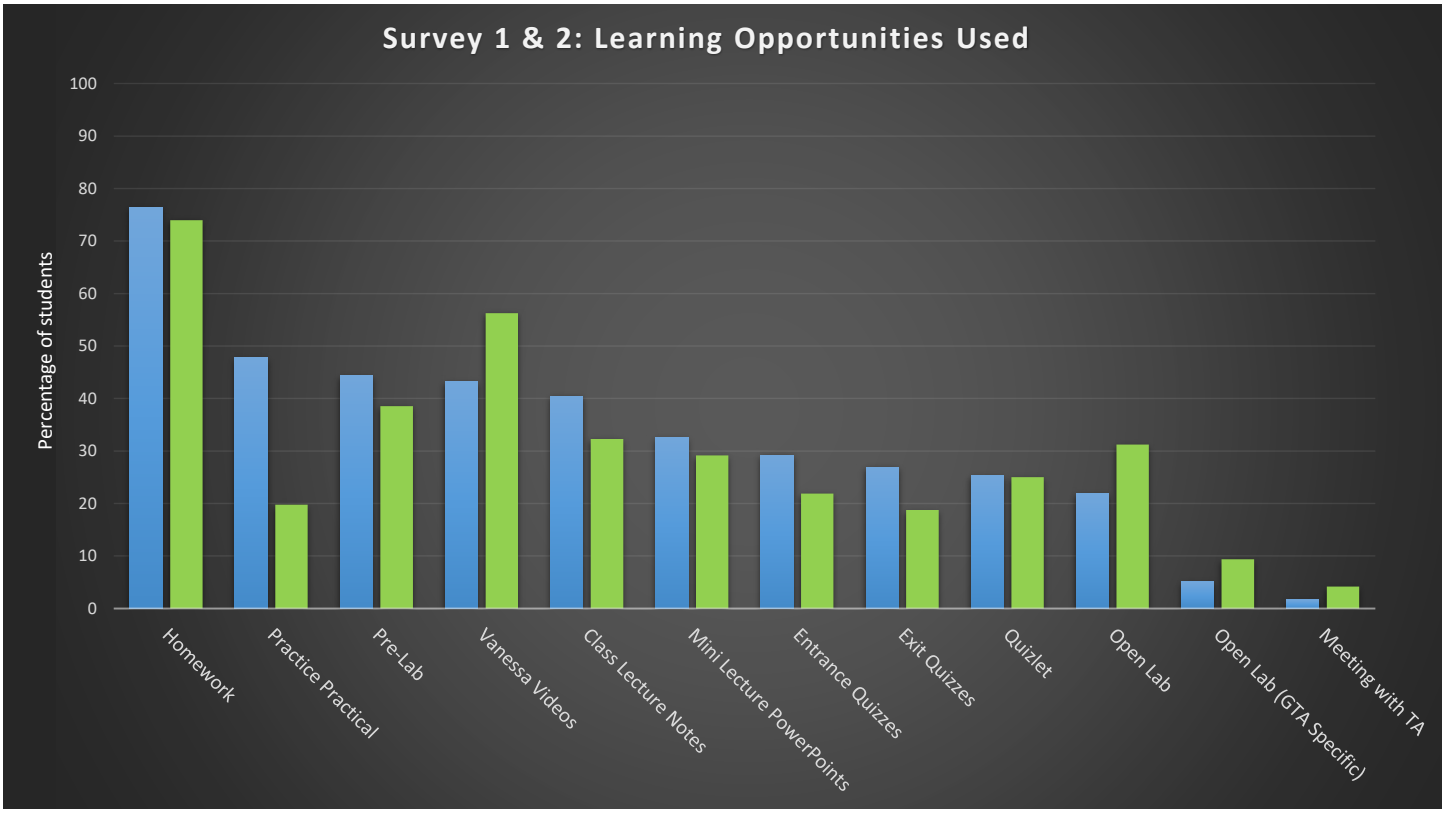

Figure 1. *Comparisons of Survey 1 (blue) and Survey 2 (green) with the learning opportunities students reported using as a study tool.*

In order to determine if the use of our learning opportunities was related to grade improvement, we implemented a dual strategy. First, the data from Survey 2 was used to compare the average number of opportunities used by students in each final grade category (A, B, C, D, F). Grades were categorized on the following scale: 90% (A), 80% (B), 70% (C), 60% (D), < 60 % (F). We found no relationship in average number of learning opportunities used and final grade earned. The second approach compared learning opportunities reported in Survey 2 with final grade, for which a strong relationship was observed (Table 2). In short, the Vanessa Videos, GTA-Specific Open Labs, and Lab Mini-lecture PowerPoints had the highest positive relationship with grades, with R^2 values of 0.563, 0.432, and 0.362 respectively. There was a slight positive relationship with grade improvement for students who sought out other learning opportunities ($R^2 = 0.150$) and/or those who went to non-GTA-specific Open Labs ($R^2 = 0.175$). Utilizing Homework PowerPoints as a learning tool had no measurable effect on the grade received ($R^2 = 0.000$). Several learning opportunities showed a negative relationship with the final grade ($R^2 = -0.671$ to -0.006), of which the Entrance Quizzes had the highest negative impact (-0.671).

Table 2. *Correlation between learning opportunity utilized with overall improvement (%) in the lab. Utilizing the Homework as a study tool was highly correlated with grade improvements between the first practical and the final grade received in the course. Students who reported watching the Vanessa Videos and visiting their GTA during open labs did not have overall improvements in their grades (discussed in text).*

Opportunity Used	R^2
Homework	0.929
Lab Mini-lecture PowerPoints	0.854
Other	0.789
Class Lecture Notes	0.288
Pre-lab Exercises	0.239
Entrance Quizzes	0.113
Quizlet	0.041
Exit Quizzes	0.009
Open Lab	0.004
GTA Specific Open Lab	-0.32
Vanessa Videos	-0.65

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In addition to investigating whether there was a relationship between the final grade earned and learning opportunities used, we also calculated whether grade improvements correlated with the number and/or type of learning opportunities used in lab. We used total lab grades at two separate checkpoints: checkpoint 1 (following practical 1) and checkpoint 2 (end of semester). The difference in total grades between the two was calculated and used to determine grade improvement for each student who completed surveys 1 and 2. Grade improvements ranged from 0.07% - 13.4%. Approximately 70% of students who completed both surveys (n = 96) improved their grades during the semester. Students who did not complete both surveys were not included in this portion of our analysis because we would have no way to determine if their behavior changed during the semester. We divided grade improvements into two broad categories: major (5% and above) and minor (below 5%) (Figure 2). Since this question asks specifically about grade improvement, we did not include data from students whose grades decreased between the first practical and the end of the semester. When analyzed by number of learning opportunities used with grade improvement category, there was no significant difference between groups

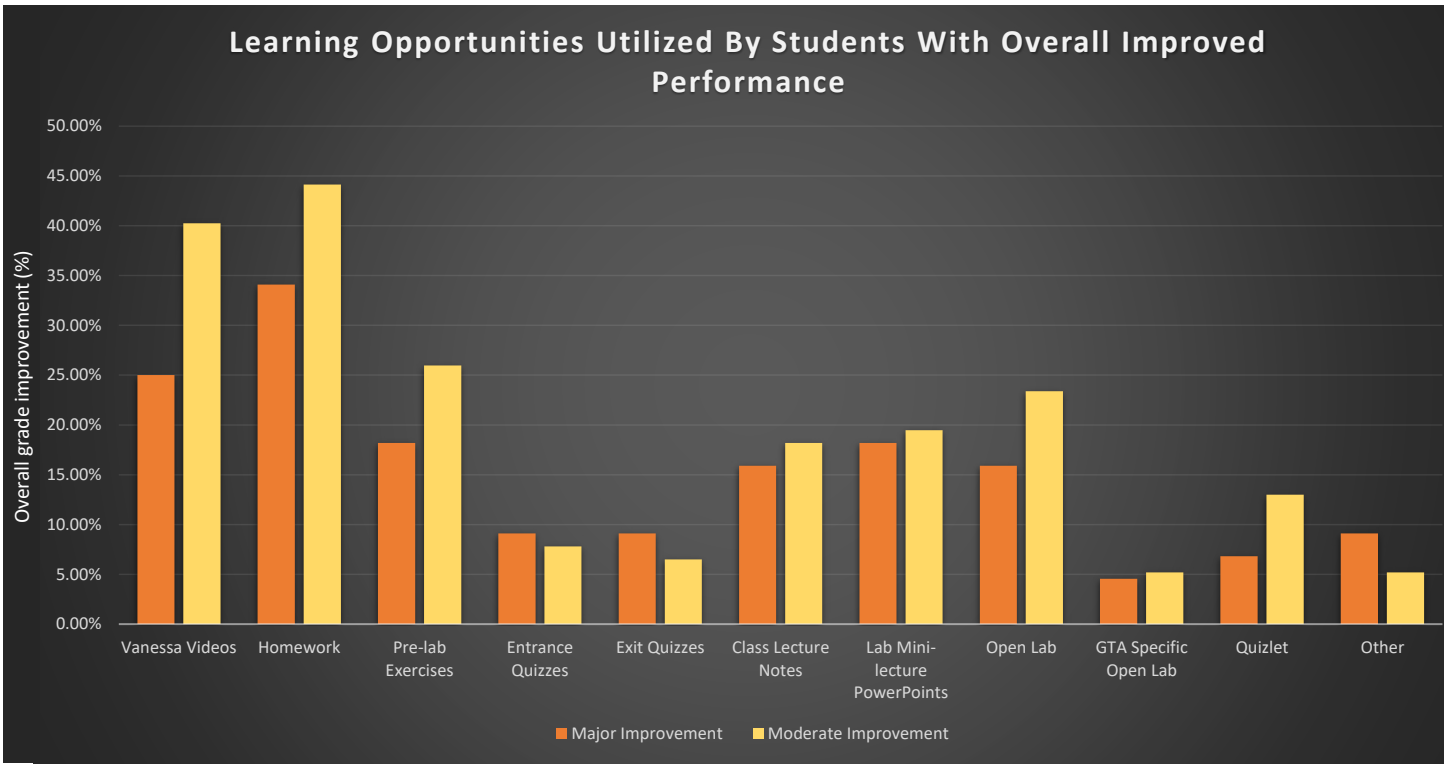

Figure 2. *Comparisons of major (orange; >5% overall grade improvement) and moderate (yellow; 1-4.99% overall grade improvement) grade improvement with the learning opportunities students reported using as a study tool.*

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We found some learning opportunities may affect grade improvement. For example, Homework, Mini-lecture PowerPoints, Other, and Class Lecture Notes all had positive relationships (R^2 = 0.929, 0.854, 0.789 and 0.288 respectively; Table 2). Vanessa Videos and Open Lab with GTA both show negative relationships (R^2 = -0.65 and -0.32 respectively; Table 2). We attribute this to the high number of A students reporting use of both learning opportunities. We calculated that 81% of students who earned A's were found in the two lowest "grade gain" categories.

In addition to investigating which learning opportunities students reported using and their relationships to grades, in the open ended question responses students reported using Homework PowerPoints, the term sheet, and Other most often on Survey 1 (25.5%, 25.2% and 21.0%, respectively. On Survey 2, students reported highest use of Homework PowerPoints, term sheets and Vanessa videos (31.8%, 21.5%, and 17.0%, respectively). On Survey 1, students reported PowerPoint Homework, term sheet, and other as most helpful (29.9%, 25.7%, and 16.4%, respectively). Survey 2 results indicted a change with students reporting Vanessa videos, Homework PowerPoints, and Other as most helpful (26.5%, 25.7%, and 16.9%, respectively.) Most students reported studying frequency as one to two times per week, closely followed by three or four times per week, and then vague responses that we were not able to quantify (27.9%, 27.3%, and 19.2%, respectively). Examples of answers counted as vague include "A lot" and "Weekly." Survey 2 showed slight changes in their answers but still reporting one to two times per week as most common, followed by three to four times per week and vague (28.1%, 25.8%, and 27.0% respectively).

Survey 2 also asked if respondents had changed how they studied during the semester. Fifty-four percent said they had and 45.5% said they had not changed how they studied. Explanations for how they changed included "I have used them more often and harder" (Participant 224). Students who did not report a change stated comments like, "These methods have worked well for me (Participant 031). The most common suggestions for improvement (25 % completing Survey 1 and 15% completing Survey 2) commented that exit quizzes were stressful and they would prefer that they were removed. For example, "Remove exit quizzes" (Participant 251) and "The exit quizzes make me feel worse about myself" (Participant 44). Tables 3 and 4 report results for all learning opportunities and study frequencies.

Table 3 *Summary of learning opportunities used most frequently and perceived as most helpful by participants. Homework PowerPoints created by the students during lab were used most often and were considered most helpful on both surveys. Use of Vanessa videos increased between Survey 1 and 2, as well as their rating of helpfulness. Students reported meeting with their GTA as a learning opportunity least often used and least helpful.*

Code	Survey 1 most often (%)	Survey 2 most often (%)	Survey 1 most helpful (%)	Survey 2 most helpful (%)
Homework ppts	25.5	31.9	29.9	25.7
terms sheet	25.2	17.0	25.7	9.6
Other	21.0	16.3	16.4	16.9
Vanessa videos	12.6	21.5	10.7	26.5
class lecture notes	3.8	0.0	2.8	0.7
open lab, any	3.5	7.4	6.2	12.5
Mini lecture ppts	2.1	1.5	0.8	0.0
pre-labs	1.7	2.2	2.3	1.5
exit quizzes	1.4	0.7	1.1	2.2
open lab, with GTA	1.0	1.5	1.1	0.0
practice practical	1.0	0.0	1.7	0.7
entrance quizzes	0.7	0.7	1.1	1.5
Meet with GTA	0.3	0.0	0.0	2.2

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Table 4 *Reported study frequencies per week. Most students reported studying once or twice per week on both Survey 1 and Survey 2. Other than those who claimed not to study, the lowest category of frequency was five or six times per week.*

Frequency per week	Survey 1 (%)	Survey 2 (%)
0	0.0	1.1
1 or 2	27.9	28.1
3 or 4	27.3	25.8
5 or 6	9.9	6.7
daily	15.7	11.2
vague	19.2	27.0

Discussion

This study began with the question, "Are the changes introduced to the lab helpful?" Similar to Sternberg (1990), we presented students with a variety of learning opportunities to try to provide methods that work for many different learning styles. It appears that our changes are helping our students. We found that having a multitude of learning opportunities both during and outside of scheduled lab time provided the greatest benefit to our students. However, we found that not all learning opportunities are equally helpful to all students. We concluded that the answer to this question depends on which students and which learning opportunities are considered. For example, students who demonstrated the largest improvements (5% or more) between the first practical compared to their final grades reported that they used the Vanessa Videos most. Students who earned A's and B's reported high use of Vanessa Videos and Homework PowerPoints. However, the A-students did not demonstrate the largest grade improvements, which we attribute to the fact that high scores do not have the potential for large improvements. In addition, the A and B-students, along with D-students, often reported using "Other" learning opportunities. Our hypothesis is that high achieving students are advanced enough in their understanding of how to seek additional sources of information independently. Our hypothesis for D-students who sought "Other" opportunities is that they are grasping for any potential opportunity to either maintain or improve their grades, thereby to avoid having to re-take the course. . These results do not imply that the learning opportunities are solely responsible for improvement in overall lab grades. We do however believe that students who utilize more resources have the potential to perform better as measured by proficiency in lab assessments.

We used data collected from Survey 2 to try to determine whether students changed the learning opportunities they used over the semester and why. We found that 54.5% (n = 90) reported changing the learning opportunities they used during the semester. However, not all students answered this question, nor did participants provide clear reasons as to why they made changes. Instead, many students simply replied with what they changed to. For example, participant 046 answered, "added Quizlet to study," and participant 134 stated, "I went to open lab and when I started to go and ask questions, I learned faster." Participant 068 answered "Yes, I did not know about the videos until the second practical." Students who answered "no" when asked if they changed study techniques generally agreed with participant 219's sentiment, "No, because they've worked well for me."

Additionally, as Armbruster *et al.* (2009) described in their article about active learning and student-centered pedagogy, we changed how we present and teach lab material and provoke students into taking initiative for their own learning through learning opportunities that encourage learning before, during, and after labs. For example, we have specifically designed the pre-labs so students begin familiarizing themselves with some of the terms for the week before coming to lab. Therefore, if they put effort into completion of the pre-labs, they have been exposed to a certain proportion of the terms before coming to lab.

Due to the negative perception and stress students reported with the "Exit Quizzes," we have reframed them as an "extra" learning opportunity (and have renamed them "Extra Credit"). This reframing strategy was implemented in the summer 2018 session. Spring 2018 semester study participants indicated high stress related to "Exit Quizzes" as they felt they only had 2.5 hours of hands-on lab time to study. We disagree with this perception of limited study time because students have access to all lab materials for the whole semester from the first day of class. Moreover, students perceive a score of 2 out of 5 points on the exit quizzes as a failing grade, even though these points earned make up only 7% of the overall final lab grade. After changing the verbiage of the assessment and denoting the outcome as extra credit worth up to five points, students' comments became positive. They saw the assessment as a chance to stockpile extra points to counteract deficiencies on practical grades, which is the largest point component of the lab.

Finally, as flipped classrooms become more common (Awidi and Paynter 2018), we have incorporated some of those methods into the way we teach our labs and those seem to be the most beneficial for our students as indicated by results tied to the Vanessa videos. Given the relationship of some of these learning opportunities to grade improvement, we plan to integrate them into curriculum (such as online quizzes over the Vanessa video's as a pre-test before lab and to get the students familiar with the material instead of pre-labs (Table 1 and 2). We can take this data and build on the items that students have used and which appear to help them learn and retain information. However, this is not what we tested. We

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just wanted to know if providing these materials really does help students; based on these results, it seems to.

Limitations of this study include low return rates on survey 2. The highest return rates for the second surveys were obtained from the three most experienced GTAs' labs. Also, the lead investigator in the study acknowledges that she should have administered surveys to all lab sections in person, which may have resulted in a higher completion rate for both surveys. Survey questions that were not specific enough or perhaps were too long, such as the two-part question asking if and why students changed the learning opportunities they used, could have been broken into two separate questions and perhaps would have resulted in clearer explanations from students. We acknowledge that making inferences about effectiveness of our techniques using information gathered from only 29.36% of students taking the class during the survey period is not ideal. Further monitoring in future semesters is proposed, particularly to include demographic information. Our university has a large first-generation college student population, and variables such as work schedules, family commitments, and socioeconomic status could all affect how students access the available materials and which they choose to use. This is an introductory anatomy and physiology class and there are no prerequisite course requirements, nor is there a GPA minimum requirement. We did not collect data from the students regarding overall GPA, nor did we ask what their past science experiences were.

Conclusion

As researchers and instructors, we feel that this research has provided feedback to improve how we will teach anatomy and physiology in the future. We have gained insight into the methods of learning that students find most effective. While our results often indicated low relationships between grade improvements and learning opportunities used, we are encouraged in our efforts by any grade improvements.

In conclusion, we hope the three articles on the processes involved in reformulating a course in the interest of student success has been interesting and helpful. We will continue adjusting and improving our teaching methods as indicated by student feedback and practical results. Integration of viewing the Vanessa videos (described in parts one and two of this series) as a pre-lab, followed by an online quiz is being considered. Using the best student homework pictures as entrance quizzes seems to encourage pride in doing their homework effectively so we will investigate the effects of that. We now conduct all of our office hours in the lab and have had positive feedback toward location as a beneficial learning opportunity. Overall, we are encouraged by the results we have seen in students' lab grades and plan to continue incorporating creative approaches that include best practices, multiple learning styles, and use of technology while also promoting hands-on learning experiences.

About the Authors

Heather Rudolph, PhD, is a community college faculty member who is passionate about teaching Anatomy and Physiology. She draws from both active and applied learning techniques in order to connect the formal classroom environment to real life experiences.

Anna Schwabe is a biology education doctoral candidate and certified scientific botanical illustrator whose teaching expertise lies in maximizing student learning while fostering a teaching environment conducive to novice student instructors in anatomy and physiology labs.

Nastaran SoleimaniBarzi Mues is a PhD candidate specializing in genetics and stem cells. While working on her PhD, she developed an interest in biology education and its implications in helping students.

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Appendix A

Survey 1 Bio 245

Name: _____ Date: _____
Lab section:_____
Please check all of the following learning opportunities you used to prepare for the practical.

☐	Terms Sheet	☐	Class Lecture Notes
☐	Vanessa YouTube videos	☐	Lab Mini- Lecture PowerPoints
☐	Homework PowerPoints	☐	Open Lab (any)
☐	Pre-Labs	☐	Open Lab (with your GTA)
☐	Entrance Quizzes	☐	Practice Practical
☐	Exit Quizzes	☐	Meeting with GTA
☐	Other (Explain.)		

Which of the above learning opportunities did you use most often?

If you used more than one learning opportunity, which one(s) did you find most helpful?

How often did you use the learning opportunity(ies) that you found most helpful?

What suggestions do you have for learning opportunities we could add to the lab or remove from the lab to help you be better prepared for the next practical?

Survey 2 Bio 245

Name: _____ Date: _____
Lab section:_____
Please circle or highlight all of the following learning opportunities you have used to prepare for this practical.

☐	Terms Sheet	☐	Class Lecture Notes
☐	Vanessa YouTube videos	☐	Lab Mini- Lecture PowerPoints
☐	Homework PowerPoints	☐	Open Lab (any)
☐	Pre-Labs	☐	Open Lab (with your GTA)
☐	Entrance Quizzes	☐	Practice Practical
☐	Exit Quizzes	☐	Meeting with GTA
☐	Other (Explain.)		

Which of the above learning opportunities did you use most often?

If you used more than one learning opportunity, which one(s) did you find most helpful?

How often did you use the learning opportunity(ies) that you found most helpful?

Have you changed the learning opportunities you used since the first practical? Please explain why or why not.

What suggestions do you have for learning opportunities we could add to the lab or remove from the lab to help you be better prepared for the next practical?

Back to TOC